

# **SUCTION NOZZLE CARRIER**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention:**

The present invention relates to a suction nozzle carrier and,  
5 more particularly, to a suction nozzle carrier for use with a vacuum  
suction apparatus to suck the workpiece for processing, which  
improves the working efficiency of the vacuum suction apparatus.

### **2. Description of the Related Art:**

When transferring or processing light workpiece (papers,  
10 circuit boards, rubber films, etc.) in a processing machine, the  
workpiece must be positively positioned before starting the  
transferring or processing operation. FIG. 9 shows carton paper  
suction roll for transferring carton papers. The carton paper suction  
roll has suction slots cut through the periphery. The suction slots  
15 are respectively connected to a vacuum pump so that the workpiece  
can be secured to the surface of the carton paper suction roll upon  
the operation of the vacuum pump. This design of carton paper  
suction roll is still not satisfactory in function. When operating the  
vacuum pump to suck air, the suction slots that are not covered by  
20 the workpiece cannot be held in a vacuum status, and much work of  
the vacuum pump is in vain. Because work of the vacuum pump is  
in vain during its operation, the service life of the vacuum pump  
will be relatively shortened.

Further, according to the utility model, entitled “Transmission Mechanism for Continuous Vacuum Forming Machine”, vacuum suction holes and recessed holes are respectively formed in the upper suction frame and the lower suction frame at locations adjacent to the vacuum tube been connected to a vacuum pump, each vacuum suction hole being mounted with a seal ring; electromagnetic valve means is adapted to control suction and release of the upper suction frame and the lower suction frame. This design enables the fed material to be processed continuously through a continuous series of processing processes including heating, shape forming, and cutting.

The seal rings in the vacuum suction holes of the upper and lower suction frames are shaped like a conventional flexible vacuum mount controlled by the vacuum pump to pick up the workpiece by suction. The use of the seal rings has numerous drawbacks as follows:

1. Movable needles are provided in the seal rings and adapted to support the workpiece, enabling the workpiece to be sucked by the seal rings. However, if the workpiece has a thin thickness or light weight, or is fragile, it tends to be pierced by the movable needles, thereby causing the seal rings unable to suck up the workpiece.

2. Vacuum suction action is started after the movable

needles touched the workpiece and the seal rings closely attached to the workpiece. If any particular movable needle not touched the workpiece, the upper suction frame or lower suction frame must be provided with a corresponding recessed hole to accommodate the  
5 corresponding movable needle. Therefore, this method requires an upper suction frame and a lower suction frame to pick up the workpiece by suction.

3. Because vacuum suction action is started after the movable needles have touched the workpiece and the seal rings  
10 have been closely attached to the workpiece, the upper suction frame or lower suction frame must be provided with recessed holes corresponding to the movable needle, complicating alignment procedure.

## **SUMMARY OF THE INVENTION**

15 The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a suction nozzle carrier, which greatly improves the working efficiency of the vacuum suction apparatus. It is another object of the present invention to provide a suction nozzle carrier,  
20 which is practical to suck workpieces of different shapes and sizes. To achieve these and other objects of the present invention, the suction nozzle carrier comprises a carrier, which has a plurality of receiving holes, and a plurality of vacuum nozzles respectively

mounted in the receiving holes of the carrier in a flush manner and adapted to suck the workpiece upon operation of the vacuum suction apparatus. Each vacuum nozzle comprises a valve block, a valve element movably mounted in the valve block and adapted to close/open the valve block, and a spring member supporting the valve element in the valve block and adapted to force the valve element to close the valve block. The carrier may be provided in any of a variety of forms. For example, the carrier can be made in the form of a roll or work table.

## **10 BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is an elevational view of a suction nozzle carrier according to the present invention.

FIG. 2 is an elevational oblique front view of a suction nozzle for suction nozzle carrier according to the present invention.

**15** FIG. 3 is an elevational oblique rear view of the suction nozzle shown in FIG. 2.

FIG. 4 is an exploded view of the suction nozzle shown in FIGS. 2 and 3.

FIG. 5 is a sectional plain view of FIG. 4.

**20** FIG. 6 is a sectional view in an enlarged scale of a part of the suction nozzle carrier according to the present invention, showing the spring member compressed and the spherical valve element sealed the air passage of the plug cap of the valve block."

FIG. 7 is a sectional view in an enlarged scale of a part of the suction nozzle carrier according to the present invention, showing the workpiece sucked and secured to the surface of the carrier.

5           FIG. 8 is an elevational view of an alternate form of the suction nozzle carrier according to the present invention.

FIG. 9 is an elevational view of conventional carton paper suction roll.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

10           Referring to FIG. 1, a suction nozzle carrier is shown for use with a vacuum suction apparatus (not shown), comprising a carrier 2, and a plurality of suction nozzles 1 mounted in receiving holes 21 in the periphery of the carrier 2 in a flush manner.

          Referring to FIGS. 2~6 and FIG. 1 again, each suction  
15   nozzle 1 is comprised of a valve block 11, a spherical valve element 12, an outer gasket ring 13, an inner gasket ring 131, and a spring member 14. The valve block 11 is comprised of a hollow cylindrical shell 111 and a plug cap 112 closing the bottom open side of the hollow cylindrical shell 111. The hollow cylindrical  
20   shell 111 comprises a receiving open chamber 1111 axially extended through the bottom side, an annular shoulder 1112 in the periphery of the receiving open chamber 1111, a plurality of air holes 1113 in the top side in communication with the receiving

open chamber 1111, an outside annular groove 1114 extended around the periphery. The plug cap 112 is plugged into the receiving open chamber 1111 and stopped outside the bottom side of the hollow cylindrical shell 111, having an axially extended  
5 stepped center through hole formed of a big diameter section 1121 and a small diameter section 1122. The big diameter section 1121 is disposed in communication with the receiving open chamber 1111 directly. The spherical valve element 12 is inserted into the receiving open chamber 1111. The outer gasket ring 13 is mounted  
10 in the outer annular groove 1114 of the hollow cylindrical shell 111. The inner gasket ring 131 is mounted inside the receiving open chamber 1111 and stopped between the annular shoulder 1112 and the plug cap 112. The spring member 14 is mounted in the receiving open chamber 1111, and stopped between the spherical valve  
15 element 12 and the connection area (step) between the big diameter section 1121 and the small diameter section 1122.

Referring to FIGS. 6 and 7, when the suction nozzles 1 installed in the respective receiving holes 21 of the carrier 2, the axially extended stepped center through the big diameter section  
20 1121 and the small diameter section 1122 of each suction nozzle 1 is disposed in communication with a respective suction hole 211 in the inside wall of the carrier body 2, and the outer gasket ring 13 of each suction nozzle 1 seals the gap between the carrier body 2 and

the respective suction nozzle 1.

Referring to FIGS. 1, 6 and 7 again, the carrier 2 according to this embodiment is a roll. When the vacuum suction apparatus does no work, the spring member 14 of each suction nozzle 1 forces the respective spherical valve element 12 to close the air holes 1113 of the respective valve block 11. When the operator places the workpiece 3 on the surface of the carrier 2, the vacuum suction apparatus is started to suck air from the suction holes 211. During the operation of the vacuum suction apparatus, air is drawn away from the air holes 1113 and receiving open chamber 1111 of the valve block 11 of each suction nozzle 1 being covered by the workpiece 3, and therefore the workpiece 3 is sucked and firmly secured to the surface of the carrier 2. When the air holes 1113 of each suction nozzle 1 being covered by the workpiece 3 is airtightly sealed by the workpiece 3, no pressure difference exists, and the spring member 14 supports the spherical valve element 12 at a distance away from the plug cap 112. At the same time, the spherical valve element 12 of each suction nozzle 1 not covered by the workpiece 3 is drawn downwards to compress the respective spring member 14 and the inner gasket ring 131 and to further seal the axially extended stepped center through the big diameter section 1121 and the small diameter section 1122 of the respective suction nozzle 1, preventing continuous suction action at

the suction nozzles 1 not covered by the workpiece 3. When the operator removed the workpiece 3 from the carrier 2, the spherical valve elements 12 of the respective suction nozzles 1 are immediately drawn downwards to close the respective valve blocks 5 11. Therefore, the vacuum suction apparatus works efficiently, saving the consumption of electric energy.

FIG. 8 shows an alternate form of the present invention. According to this embodiment, the carrier 2 is made in the form of a work table, having evenly distributed and vertically extended 10 receiving holes 21, which hold the suction nozzles 1 respectively.

A prototype of suction nozzle carrier has been constructed with the features of FIGS. 1~8. The suction nozzle carrier functions smoothly to provide all of the features discussed earlier.

Although particular embodiments of the invention have 15 been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. For example, the carrier can be made in the form of a conveying device, or in any of a variety of shapes. Accordingly, the invention is not to be limited 20 except as by the appended claims.